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Forest Insect and Disease Conditions

British Columbia & Yukon 1982

C.S. Wood and G.A. VanSickle
Pacific Forest Research Centre
Victoria, British Columbia

84- 3185 /

FOREST INSECT AND DISEASE CONDITIONS

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and
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Canada

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ABSTRACT

This summary of forest pest conditions in British Columbia and the Yukon in 1982 was compiled from records and field reports of 11 Forest Insect and Disease Survey technicians. Emphasis is on damaging pests that are, or may become, major management problems.

RESUME

Ce sommaire relatif à l'état des ravageurs forestiers en Colombie-Britannique et au Yukon en 1982 fut catalogué à partir des archives et des rapports sur les travaux effectués dans le champ par 11 techniciens des insectes et maladies des arbres. L'accent est mis sur les ravageurs qui sont ou pourraient devenir de sérieux problèmes de gestion.

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Introduction

The six Forest Insect and Disease Survey units of the Canadian Forestry Service are responsible for producing a national overview of important pest conditions and their implications; maintaining records and surveys to support quarantines; supporting forestry research through maintenance of records, herbaria, and insect collections; and providing advisory services concerning forest insect and disease conditions. General surveys to detect and monitor important insect and diseases are conducted annually in the Pacific Region with the cooperation of many federal, provincial, industrial, and municipal agencies.

This regional report reviews the impact and status of major forest insects and diseases throughout British Columbia and the Yukon Territory in 1982 and forecasts some pest conditions for 1983. The information is compiled primarily from the observations and field records of eleven Forest Insect and Disease Survey Rangers during their field assignments extending from late May to October. More detailed information for each provincial forest region is available in file reports compiled by the following rangers.

Cariboo Forest Region:
- Dick Andrews

Kamloops Forest Region:
- Colin Wood; Henry Woensdregt (resigned September 1982); Bob Ferris (part)

Nelson Forest Region:
- Peter Koot, Rod Garbutt

Prince George Forest Region:
- Bob Erickson, Jim Loranger

Prince Rupert Forest Region:
- Leo Unger, Nick Humphreys

Vancouver Forest Region:
- Roly Wood, John Vallentgoed

Other staff of the Forest Insect and Disease Survey project in 1982 were as follows:

- Bob Duncan, Insectary Technician
- Dave Evans, Entomologist i/c Insectary and Collection
- John Hopkins, Pathologist i/c Herbarium
- Daphyne Lowe, Herbarium Technician
- Ernie Morris, Chief FIDS Ranger (resigned August 1982)
- Erika Pass, Insectary Technician
- Terry Shore, Pest Survey Sampling Officer
- Joan Strobbe, Secretary
- Allan Van Sickle, Head of the Forest Insect and Disease Survey Unit.

Summary

The most significant insect problem of mature forests continued to be the **mountain pine beetle**, which since 1972 has killed an estimated 92 million trees. Most infestations continued to expand and intensify in 1982 with 56 million trees killed over 90 000 ha throughout the province. The largest outbreak areas were in the Cariboo Region.

The area in which mature spruce trees were killed by the **spruce beetle** increased throughout the province to 99 000 ha from 86 000 ha in 1981. Volumes affected exceeded 4.4 million m^3. The major increase occurred in the Prince Rupert Region but the greatest concentration of damage continued to be in the Prince George Region.

Douglas-fir stands defoliated by **western spruce budworm** declined 20% to 17 000 ha of mostly light to moderate intensity in the Kamloops area. For the first time in more than a decade, defoliation was not recorded in the Vancouver Region. Little change in status is expected in 1983.

In the Cariboo, Prince George, Kamloops, and Nelson regions, the **two-year cycle spruce budworm** population, which defoliated more than 365 000 ha of alpine fir-spruce stands in 1980, collapsed in 1982. In the Prince Rupert Region, the current year's foliage of alpine fir-spruce stands over 90 000 ha in the Meziadin Lake, Bell-Irving, Nass, Kispiox, and Babine river drainages and near Atlin was lightly to moderately defoliated by a budworm. Larval development indicates that the population which was previously identified as two-year cycle is predominantly on a one-year cycle. In 1981, the infestation, mainly in the Meziadin Lake area, covered 38 000 ha.

In 1982, the second year of a **Douglas-fir tussock moth** outbreak, severe defoliation in the Okanagan-Thompson area totalled 12 000 ha, an elevenfold increase over 1981. Localized infestations continued in adjacent areas of the Cariboo Region and near Christina Lake and Chilliwack. A nuclear polyhedrosis virus has reduced population in some areas but the outbreak is expected to continue in most areas in 1983.

The **western false hemlock looper** severely defoliated Douglas-fir stands over 1 150 ha in the Salmon Arm-Shuswap area of the Kamloops Region—three times the 350 ha defoliated in 1981, the first year of the current outbreak.

Western hemlock and western red cedar stands, totalling 6 500 ha in the Revelstoke area, were lightly to moderately defoliated by the **western hemlock looper**. A previous infestation in this area collapsed in 1974.

Larch sawfly moderately defoliated 12 000 ha of western larch stands in 50 areas in the Nelson Region. Only one small area was active in 1981. In the most recent previous outbreak, a maximum of 4 600 ha were affected. Defoliation is expected to continue in most areas except at Dutch Creek. **Larch casebearer** populations continued to decline with only localized areas of very light defoliation.

The needles of 2-0 larch seedlings in an interior nursery were infected by a **needle cast disease**. Elsewhere in mature larch stands in the Nelson Region, needle cast and needle blight declined dramatically.

A fungus which causes **pine terminal crook disease** in New Zealand was found for the first time in North America in an Aldergrove nursery on western hemlock seedlings. The seedlings were subsequently destroyed and the area was treated with a disinfectant. Thorough inspections of about 70 000 seedlings which had been outplanted before the pathogen was identified indicate that the fungus may have failed to overwinter at the planting site. Inspections will continue.

At least 32 500 newly planted seedlings were destroyed or severely damaged by **black army cutworm** in several plantations in the Kamloops, Prince George, and Prince Rupert regions and populations can be expected to persist in 1983.

The high incidence of **root rots, stem diseases, dwarf mistletoes,** and **terminal weevils** in most age classes of pine, spruce, and Douglas-fir continued to be serious and widespread in Coastal and Interior stands, causing mortality and growth loss and affecting forest management programs.

The high incidence of infection of pine by **needle casts** induced by a wet summer in 1981 was widespread for the second year in the Cariboo, Kamloops, and Nelson regions where severe infections of one-year-old needles resulted in premature loss.

Pine Pests

MOUNTAIN PINE BEETLE
Dendroctonus ponderosae

Mortality of lodgepole pine and some western white pine, killed by the 1981 beetle attack, was sketch mapped over 290 500 ha from the international border to north of Smithers (see map). More than 55 million trees (15.7 million m^3) were killed in the more than 5 000 infestation areas. The greatest losses continued in the Cariboo and Nelson regions, with significant mortality in the Kamloops, Prince Rupert, and Prince George regions (Table 1).

The incidence of current attacks observed in prism cruises of representative stands averaged 19% (range 0 to 51%). On this basis, an estimated 45 million mature lodgepole pine trees were attacked in 1982, mainly in the Cariboo Region. The data indicate that infestations should continue at a slightly reduced rate in 1983.

The widespread infestations in the Cariboo Region expanded significantly to 220 000 ha, the largest area of pine mortality in the province, containing an estimated 50 million killed trees. The largest outbreak persisted in the west Chilcotin region near Tatla, Anahim, Kloakut, and Gaspard Lakes and Chezacut. The incidence of 1982 attacked trees in 13 representative stands averaged 16% of the stems per hectare (range 0 to 51%), which will result in a slightly reduced overall level of tree mortality in 1983. However, in the Tsuniah Lake, Puntzi Mountain, and Cochin Lake areas where current attacks were 42%, 44%, and 51%, respectively, the incidence of tree mortality will be high.

An estimated 4.3 million lodgepole pine were killed in the Nelson Region in 2 600 infestations over 38 000 ha. A major reduction occurred in the Flathead River Valley where most of the mature, susceptible lodgepole pine had been killed since 1977. Elsewhere along the British Columbia-Alberta border, infestations in the Elk River Valley persisted at reduced levels, but increased in Kootenay National Park and the White River drainage. In Yoho Park and in Toby and Findlay creeks, infestations changed little, but in the Kettle River Valley, they declined slightly. The incidence of 1982 attack in selected stands declined to 6%, indicating a reduced level of tree mortality in 1983. Western white pine mortality occurred primarily in the McNaughton and Upper Arrow lakes areas.

Outbreaks in the Fraser and Okanagan Valley drainages of the Kamloops Region decreased to about 350 infestation areas totalling 22 000 ha. The major decline occurred in the Gold Bridge-Downton-Carpenter Lake areas where much of the mature pine has already been killed. However, major outbreaks continued in the Stein River Valley, in the Trout-Hayes creeks area; in the Mission and Belgo creeks; in the Summers, Shorts, and Lambly creeks west of the Okanagan Valley; and in the Ashnola River valley south of Hedley. Limited assessments of current attack indicated continuing outbreaks in 1983 at slightly reduced levels. The harvesting and access development in pine stands in the western portion of the region was significantly reduced by the economic downturn.

In the Prince Rupert Region, the number of recently killed trees in more than 500 infestations increased to 300 000 over 6 250 ha. The increase was attributed to the increased incidence of the 1981 attack, high brood survival, and continued availability of susceptible pine. The major outbreak area in Harold Price Creek, active since 1972, contained 75 000 recently killed trees in 1 600 ha. Other outbreaks continued in the Kispiox, Nass, and Dean river valleys and throughout the Kitwanga-Skeena-Hazelton areas. The high levels of current attack, averaging 35%, indicate that similar levels of tree mortality will occur in 1983.

In the Prince George Region, outbreaks in lodgepole pine west of Fort St. James and near Valemount contained the majority of the 16 000 pine trees killed over 1 500 ha. An estimated 6 700 western white pine were killed in the Canoe Reach area of McNaughton Lake. No major change in status is expected in 1983.

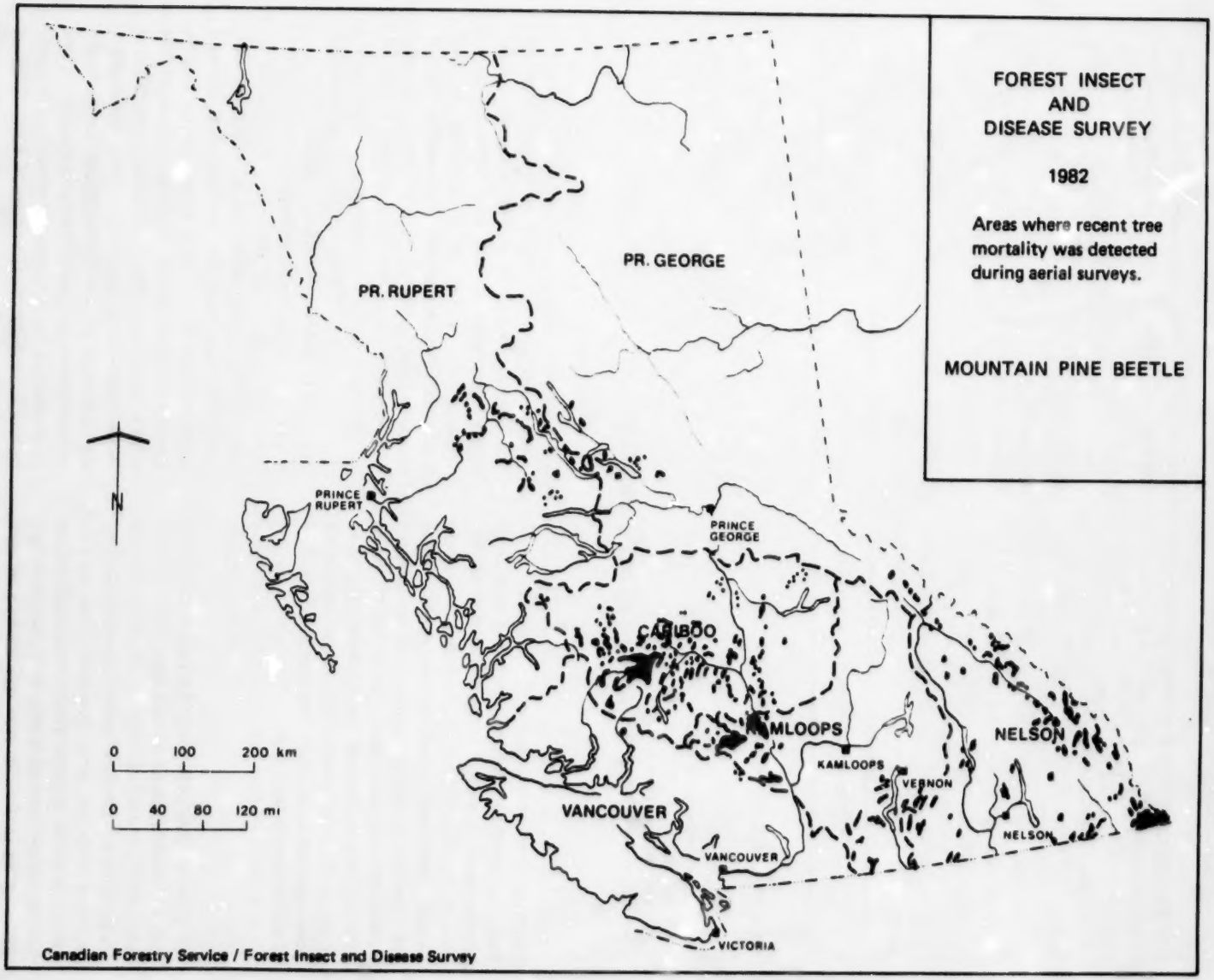

FOREST INSECT
AND
DISEASE SURVEY
1982
Areas where recent tree mortality was detected during aerial surveys.
MOUNTAIN PINE BEETLE
PR. RUPERT
PR. GEORGE
N
PRINCE RUPERT
PRINCE GEORGE
CARIBOO
KAMLOOPS
NELSON
VERNON
VANCOUVER
VICTORIA
0 100 200 km
0 40 80 120 mi
Canadian Forestry Service / Forest Insect and Disease Survey

Table 1. Number and area of mountain pine beetle infestations by provincial region based on recently killed trees observed during aerial surveys and limited ground observations, British Columbia, 1982.

Region	No. of Infest-ations	Area (ha)	Trees Attacked in 1981		No. of Stands Cruised	Average % of Trees[b]				
			Number[a]	Volume (m^3)		H	C	R	G	P
Cariboo	1 750	222 000	50 000 000	13 600 000	13	57	16	18	8	1
Kamloops	350	22 000	900 000	257 000	----	----	----	----	--	--
Nelson	2 600	38 000	4 300 000	1 590 000	6	57	6	27	7	3
Prince George	100	1 500	16 000	3 200	----	----	----	----	--	--
Prince Rupert	600	6 500	300 000	230 000	6	36	35	20	8	1
Vancouver	8	500	3 000	800	----	----	----	----	--	--
Total	5 408	290 500	55 519 000	15 681 000	25	50	19	22	8	1

[a] Trees attacked in 1981, discolored in 1982

[b] H = healthy
C = current, attacked in 1982
R = red, attacked in 1981
G = grey, attacked prior to 1981
P = partial attack (strip attack)

Localized infestations persist in the Vancouver Region where 3 000 trees were killed in eight infestations, mainly in the Homathko-Klinaklini river areas west of the major Chilcotin outbreaks in the Cariboo Region. Elsewhere, small infestations persist in Haylmore and Specht creeks and near the east gate area of Manning Park where initial efforts during 1982 to control the beetle were encouraging. Currently infested trees totalled only about 250 in the park and a fell-burn control program should be completed before the 1983 flight.

DWARF MISTLETOE
Arceuthobium spp.

Dwarf mistletoe continues to be a significant problem in many lodgepole pine, Douglas-fir, and western larch stands in Interior British Columbia and in coastal western hemlock stands. In a pilot study, the incidence of dwarf mistletoe was assessed in eight lodgepole pine stands near Tatla Lake following several years of attack by mountain pine beetle. Up to 65% of the larger mature trees had been killed, under which varying amounts of advanced regeneration existed. An average of 15% (range 0 to 55%) of the regeneration was already infected with dwarf mistletoe, and as 43% of the surviving overstory trees were infected, a source of continuing infection remains.

RED BAND NEEDLE DISEASE
Dothistroma pini

This needle blight, which causes reddening and premature loss of foliage, caused moderate and severe discoloration of pines in the Nelson Region. Most of the year-old needles on western white pine were infected near Hills, Summit Lake, and Vallican in the Slocan Valley and between Nelson and Salmo. Up to 30% of the year-old needles of immature and mature ponderosa pine were also affected in the Elko-Grasmere area, where another pine needle disease, *Leptomelanconium cinereum*, had been severe from 1978 to 1980. This latter fungus also caused generally light discoloration of lodgepole pine near Cranbrook.

A PINE NEEDLE CAST
Lophodermella concolor

Discoloration and premature drop of one-year-old needles were common in lodgepole pine stands throughout interior British Columbia and the southern Yukon. Half or more of the year-old needles were affected in a recently spaced stand near Quesnel; in regeneration near Lac La Hache and along Tranquille River, northwest of Kamloops; and in patches in young stands near Cranbrook. Severe discoloration occurred in pine stands around Watson Lake, Yukon.

ELYTRODERMA NEEDLE DISEASE
Elytroderma deformans

Brooming caused by systemic infections was common throughout the range of ponderosa pine in the Kamloops Region. Influenced by heavier than normal rainfalls during late spring-early summer in 1980 and 1981, older needles were infected and cast. Localized discoloration in ponderosa pine stands occurred throughout the Kamloops Region and between Rock Creek and Grand Forks. Infected lodgepole pine stands were common in the Nelson Region between Yahk and Moyie in the Upper Kootenay and Lussier river drainages, and symptoms typical of the disease affected 20 to 40% of the immature pine over 200 ha in the Driftwood Fire area west of Spillimacheen.

Spruce Pests

SPRUCE BEETLE
Dendroctonus rufipennis

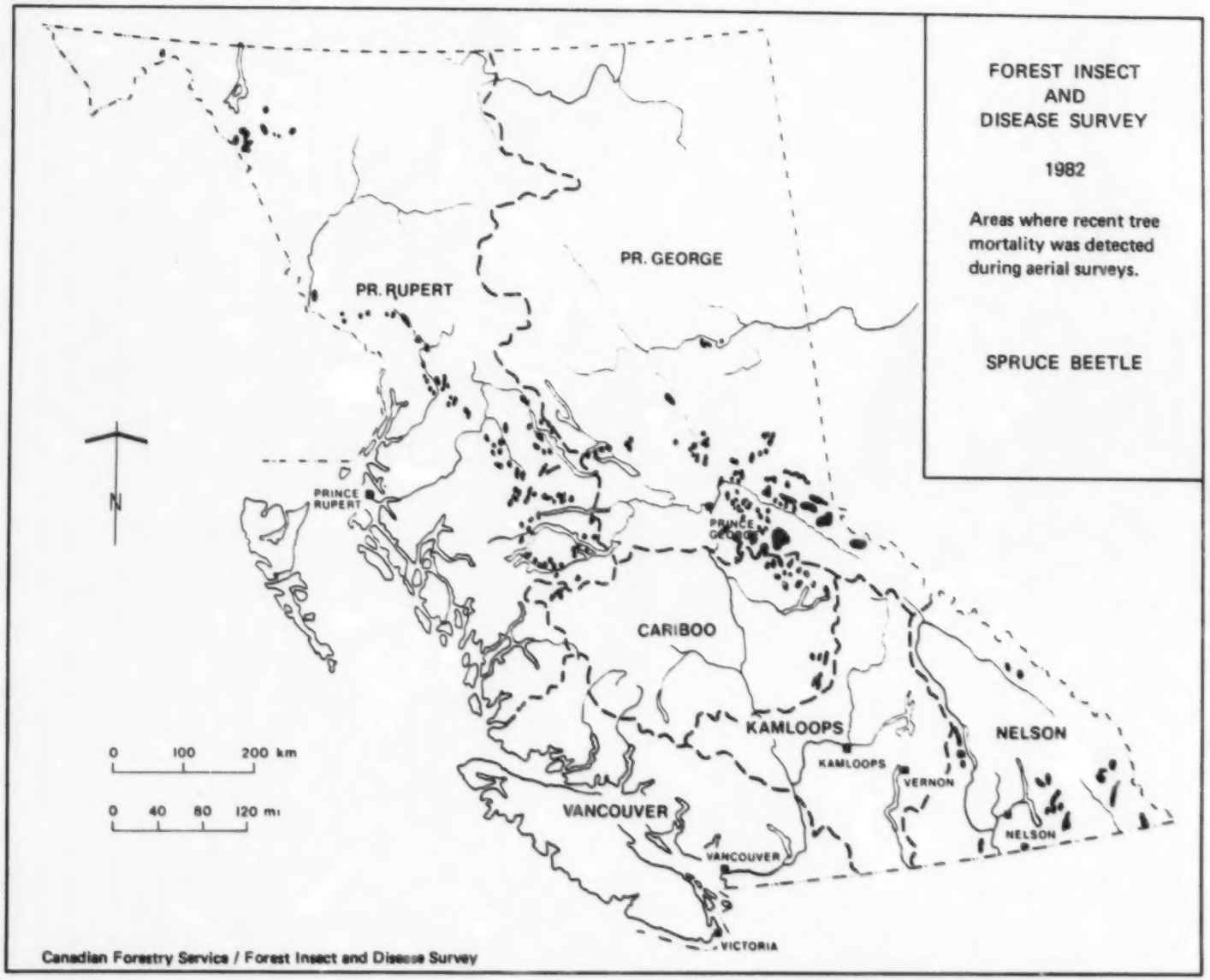
The area of mature white and Engelmann spruce killed by 1980-1981 beetle attacks covered about 99 000 ha (see map), mostly in the Prince George, Prince Rupert, and Cariboo regions (Table 2), an increase from 86 290 ha in 1981.

Although infestations in the Prince George Region continued and intensified, the increase was most evident in the Prince Rupert Region where the number of trees killed increased to 670 000 over 24 000 ha, up from 81 000 over 6 240 ha in 1981. Overwintering mortality of the 1980-1981 broods was low throughout the region and up to half the 1981 broods matured in one year, instead of the normal two. This, combined with the larger maturing two-year-cycle population from 1980, contributed to the increase in area and intensity of tree mortality in 1982. The increase occurred throughout much of the southern part of the region, including the Eutsuk-Tetachuck lakes area; the Morice, Fulton, and Bell-Irving drainages; and an isolated 3 000 ha area in the Taku River Valley south of Atlin, part of a previously active outbreak in adjacent Alaska.

Potentially epidemic levels of spruce beetle developed between kilometres 70 and 83 of the Haines Road, in the Prince Rupert Region, southwest of Whitehorse, Yukon. Road improvements, started in 1979, initially predisposed the mature spruce to attack in 1980. An estimated 150 to 200 trees, predisposed by injury or stress and attacked in 1982, contain larval broods and some adults, the majority of which could mature in 1984.

Although trap-tree programs in localized areas in the Bulkley Lakes and Morice TSAs absorbed a proportion of the 1982 flight, populations remain high in standing trees throughout the region.

In the Prince George Region, the Bowron, Willow, and McGregor drainages contained the largest area and the highest incidence of attack, with smaller infestations in the McBride, Stuart-Trembleur lakes, and Sukunka River drainage south of Chetwynd. Of the total affected area, 22% was classed severe,


FOREST INSECT
AND
DISEASE SURVEY
1982
Areas where recent tree mortality was detected during aerial surveys.
SPRUCE BEETLE
PR. RUPERT
PR. GEORGE
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PRINCE GEORGE
CARIBOO
KAMLOOPS
KAMLOOPS
VERNON
NELSON
NELSON
VANCOUVER
VANCOUVER
VICTORIA
N
0 100 200 km
0 40 80 120 mi
Canadian Forestry Service / Forest Insect and Disease Survey

Table 2. Number and area of spruce beetle infestations by Provincial Forest Region based on 1980 and 1981 killed trees observed during aerial surveys and limited ground observations, British Columbia, 1982.

Region	No. of Infestations	Area (ha)	Volume Killed ('000 m^3)	No. of Stands Cruised	Average % of Trees[a]				
					H	C	R	G	P
Cariboo	150	10 750	585	4	28	43	0	24	5
Nelson	185	7 000	250	2	48	9	30	3	10
Kamloops	10	50	--------	----	----	----	----	----	----
Prince George	980	57 500	2 000	13	52	14	12	18	4
Prince Rupert	525	24 000	1 600	9	35	33	21	8	3
Total	1 850	99 300	4 435	28	41	25	16	13	5

[a] H = healthy
C = current, attacked in 1982
R = red, attacked in 1980
G = grey, attacked prior to 1980
P = partial attack (strip)

with more than 31% of the trees killed and 25% being classed as moderate. The incidence of currently infested spruce trees in 13 stands cruised in the McGregor, Willow, and Bowron river areas ranged from 2 to 68% and averaged 14%. Although the levels of attack should be reduced in 1983, the high numbers of healthy broods indicate attacks will again increase in 1984, when the majority of the population matures.

In the adjacent area of the Cariboo Region, the infested area declined from 13 000 ha in 1981 to 10 700 ha, nearly half of which was in Bowron Lakes Provincial Park. The decline was due mainly to logging of infested stands. Less than 30% of trees were recently dead in most of the stands, but current attack averaged 43% in the Crescent and Ketchum lakes areas. This and the high numbers of larval broods indicate a significant increase in tree mortality and 1984 attacks.

About 185 infestations in the Nelson Region covered 7 000 ha. The largest infestation was in 3 500 ha in Pingston Creek near Revelstoke, with smaller outbreaks along Cabin and Sage creeks in the Flathead River Valley, in the Beaverfoot River Valley east of Golden, and in the Summit Creek area near Creston, where localized infestations also occurred along Kid and Kianuko creeks. Limited assessments of current attack and brood development indicate a reduction in intensity and extent in 1984, particularly in Pingston and Sage creeks where host depletion is a major factor.

The number of spruce beetle-killed trees in the Kamloops Region remained at low levels in localized areas in the Clearwater, Blue River, Salmon Arm, Lillooet, and Princeton areas. Previous outbreaks in the 1960s and 1970s have resulted in improved monitoring and salvage programs in previously chronic infestation areas.

SPRUCE APHID
Elatobium abietinum

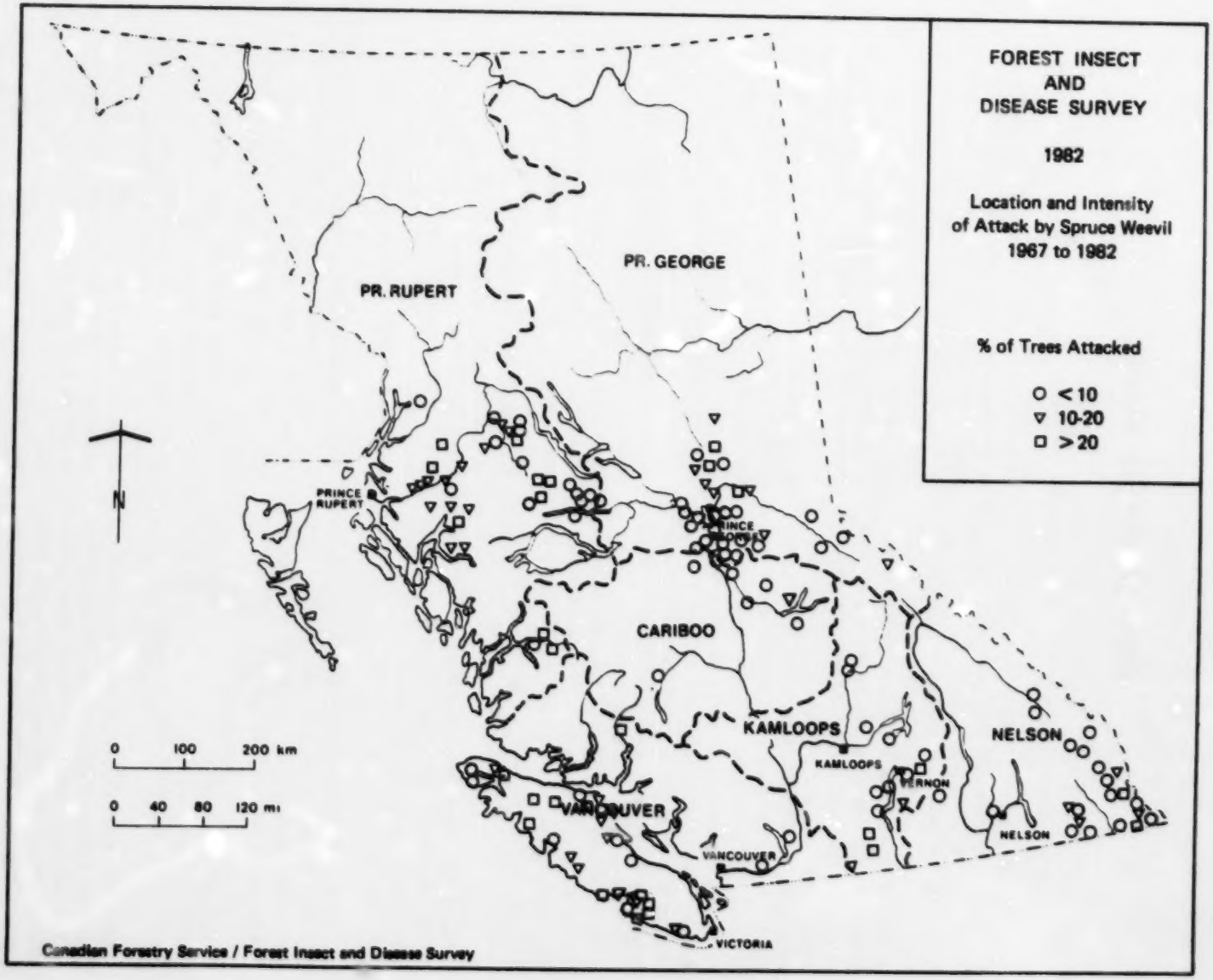
The collapse of aphid populations which had severely defoliated Sitka spruce on the Queen Charlotte Islands and in many coastal areas of the Prince Rupert Region was attributed to cold temperatures during the 1981-1982 winter. In one of the most severely damaged stands on Graham Island, successive defoliation from 1976 to 1981 resulted in tree mortality which ranged from 7% of the trees greater than 50 cm diameter to 48% of the smaller trees less than 30 cm diameter.

SPRUCE WEEVIL
Pissodes strobi

A summary of surveys in 310 immature Sitka, white, and Engelmann spruce stands throughout the province between 1967 and 1982 shows 65% were damaged in the year of examination (Table 3) (see map). Within stands, trees with currently attacked leaders averaged 9% in the Prince George Region to 18% in the Vancouver Region. In 1982, the incidence of current attack in regeneration Sitka spruce in seven areas on Vancouver Island averaged 15% and ranged from 0% in Pacific Rim National Park and in the Nimpkish Valley to 40% near Fair Harbour. In the Sayward Forest near Campbell River, a special survey of spruce provenance trials showed that 67% of the trees were affected, 30% having been attacked in 1982.

Table 3. Summary of spruce weevil surveys by the Forest Insect and Disease Survey in British Columbia, 1967 to 1982.

Region	No. of Stands Surveyed			% of Trees Currently Attacked	
	Attacked		Not Attacked		
	Current	Previous		Average	Range
Cariboo	3	1	1	15	5-25
Kamloops	19	9	28	16	1-85
Nelson	23	2	8	14	1-72
Prince George	58	----	2	9	1-40
Prince Rupert	47	6	8	11	1-45
Vancouver	52	7	36	18	2-80
Total	202	25	83	13	1-85


FOREST INSECT
AND
DISEASE SURVEY
1982
Location and Intensity
of Attack by Spruce Weevil
1967 to 1982
% of Trees Attacked
< 10
10-20
> 20
PR. RUPERT
PR. GEORGE
CARIBOO
KAMLOOPS
NELSON
VANCOUVER
VICTORIA
PRINCE RUPERT
KAMLOOPS
VERNON
NELSON
VANCOUVER
N
0 100 200 km
0 40 80 120 mi
Canadian Forestry Service / Forest Insect and Disease Survey

Douglas-fir Pests

DOUGLAS-FIR TUSSOCK MOTH
Orgyia pseudotsugata

There was an elevenfold increase in the area of Douglas-fir stands defoliated by tussock moth with 12 000 ha in the Kamloops Region, 500 ha in the Cariboo Region, 300 ha in the Nelson Region, and 20 ha in the Vancouver Region (see map). Defoliation ranged from light near Hedley and Ashcroft; moderate in 18 areas from Okanagan Falls to Westbank, Heffley Creek, and Deadman Creek; to severe over 9 000 ha, 75% of the total. The heaviest feeding was in the North Okanagan in the Armstrong-Falkland area and from Chase to the largest and most severely defoliated areas in the Pritchard-Monte Creek area where stands had been severely defoliated in 1981, the first year of this outbreak. Severely defoliated stands, from 30 to 1 000 ha in size, also occurred west at Monte Creek to Barnhart Vale, along Deadman and Cache creeks to Veasy Lake, and on Campbell Hill to Oregon Jack Creek, to south of Spences Bridge.

Areas of moderate to severe defoliation in the Scottie and Maiden creeks areas in the Cariboo Region were contiguous with defoliated areas in the Bonaparte River drainage north of Cache Creek.

In the Nelson Region, light defoliation occurred in the Rock Creek area and a localized patch of light and moderate defoliation extended over 20 ha in the Christina Lake Golf Course area.

Only localized infestations occurred in the Vancouver Region near Clearbrook and at the Chilliwack Golf Course and on scattered urban trees in Victoria.

Pheromone-baited traps at 30 locations in the Kamloops and Cariboo regions attracted numerous adult males, but when infestations occur, traps quickly become saturated and indicate only that a population persists. Predictions for 1983 were based on egg mass surveys at 49 locations in the Kamloops Region, 3 in the Cariboo, and 2 in the Nelson Region (Table 4).

Continuing populations and patchy defoliation are likely in most areas, with the exception of the Similkameen River Valley west and east of Hedley where a nuclear polyhedrosis virus (NPV) was applied in 1981; and near Armstrong and south of Chase where the naturally occurring NPV virus greatly reduced pupal survival. Moderate to severe defoliation is predicted in the Kamloops, Falkland, Winfield, Westbank, and Olalla areas. Trace to light defoliation in localized patches is predicted in the North Thompson Valley from Paul Creek to Louis Creek, south of Savona, Cache Creek, Monte Lake, and Armstrong. The influence of climate, virus, or parasites on overwintering egg masses could still alter the prediction.

Defoliation will also be common in patches in many areas not surveyed for eggs but which contained high numbers of healthy larvae, such as the north Okanagan, from Monte Creek-Pritchard west to Deadman and Cache creeks, and south to Spences Bridge.

Estimates of Douglas-fir mortality can be accurately completed only after the infestation has subsided, but of 565 trees examined in 10 severely defoliated stands in the Pritchard-Monte Creek area, 31% were dead (range 6 to 71%). Defoliation averaged 85% (range 40 to 100%) and top stripping was common.

Spray trials and control programs were conducted by several agencies and private landowners, with varying levels of success, in the Thompson-Okanagan area. At Veasy Lake, north of Ashcroft, the Canadian Forestry Service and B.C. Ministry of Forests cooperated in an experimental spray trial with Douglas-fir tussock moth nuclear polyhedrosis virus. Population reductions ranged from 60% with the lowest dosage to 93% with the highest. Successful pupal emergence ranged from 2 to 13% in treated plots, compared to 25 to 43% in check plots. Carry-over effects are to be assessed in 1983.

An aerial spray of SEVIN-4 OIL during the larval dispersal period was applied over 120 ha near Chase by the Niskainlith Indian Band with the assistance of the B.C. Ministry of Forests. Moderate to severe

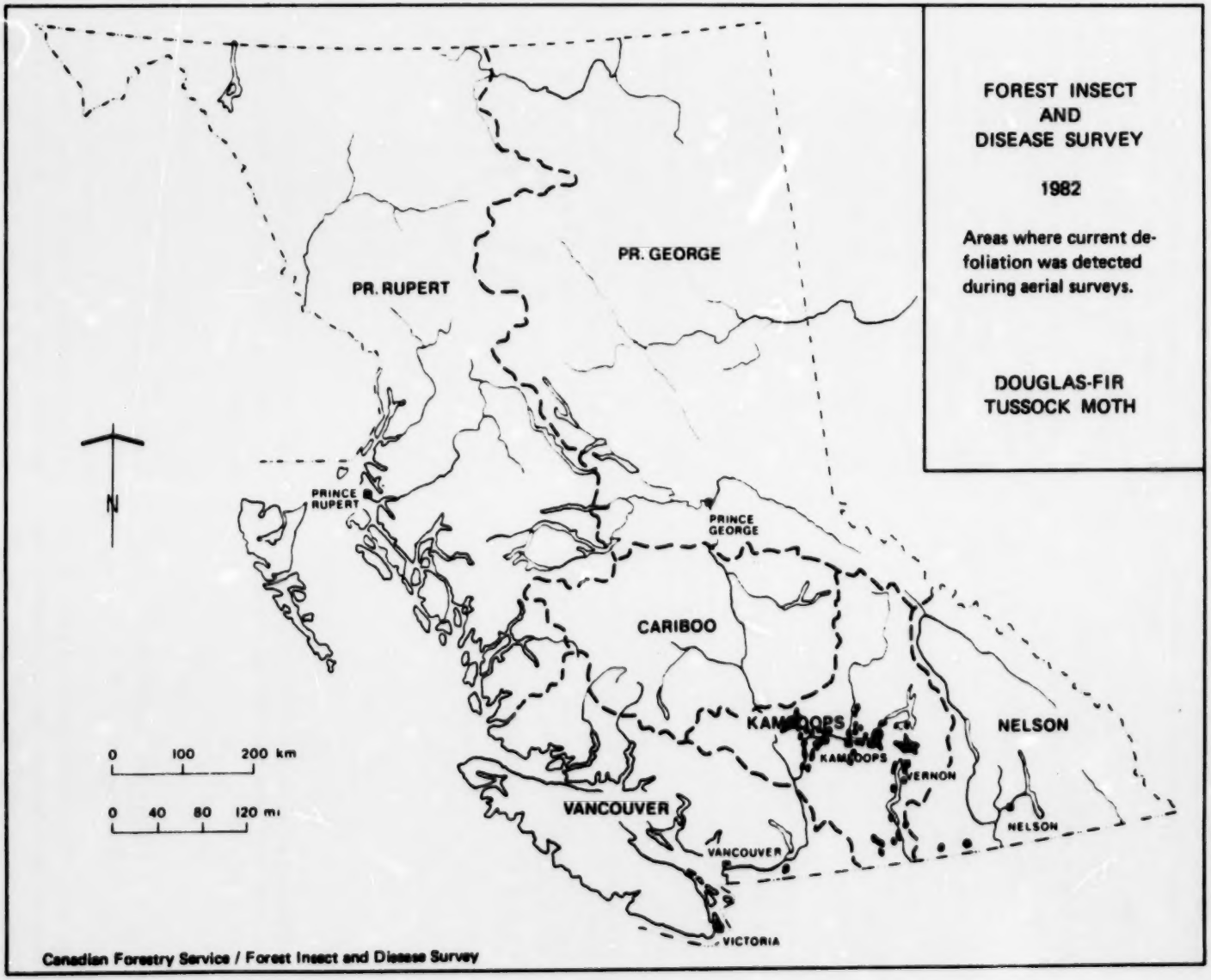

FOREST INSECT
AND
DISEASE SURVEY
1982
Areas where current defoliation was detected during aerial surveys.
DOUGLAS-FIR
TUSSOCK MOTH
PR. RUPERT
PR. GEORGE
N
PRINCE RUPERT
PRINCE GEORGE
CARIBOO
KAMLOOPS
KAMLOOPS
VERNON
NELSON
NELSON
VANCOUVER
VANCOUVER
VICTORIA
0 100 200 km
0 40 80 120 mi
Canadian Forestry Service / Forest Insect and Disease Survey

Table 4. Douglas-fir tussock moth egg mass surveys and predicted defoliation, 1982.

Location	No. of Stands Sampled	No. of Egg Masses Per Tree[a]		Predicted Defoliaton[b] 1983
		Average	Range	
Kamloops Forest Region:				
North Thompson Valley	14	0.7	0 to 11	T
Kamloops	1	6	1	S
Savona	4	0.8	<1 to 7	L
Cache Creek	3	0.8	<1 to 3	L
Monte Lake	2	0.6	0 to 3	T
Falkland	2	3.5	2 to 7	S
Armstrong	1	0.3	1	T
Westbank	3	1.1	<1 to 40	M
Hedley	7	0	0	0
Cariboo Forest Region:				
Clinton area	3	2.8	2 to 3	S
Nelson Forest Region:				
Christina Lake	1	0.6	0 to 6	T
Rock Creek	1	6.6	0 to 33	S

[a] 20 to 70 trees examined per location.

[b] Egg masses per tree and potential defoliation:

0.1 to 0.7 = (T) trace, patchy defoliation
0.8 to 2.0 = (L) (M) light to moderate
2.1 or more = (S) severe

defoliation had occurred in 1981 and overwintering egg populations were high, but no post-spray defoliation occurred.

WESTERN BUDWORM
Choristoneura occidentalis

The area of Douglas-fir stands defoliated by the budworm again declined slightly to 17 000 ha (see map), compared with 21 000 ha in 1981. The largest area of mostly light and moderate defoliation was 14 000 ha in the Ashcroft-Cache Creek-Savona area of the Kamloops Region.

A decline also occurred along Hart Ridge, Bonaparte River, and Loon Lake near Clinton where 3 000 ha were lightly defoliated.

In the Nelson Region, trace defoliation, which has persisted each year since 1977, affected 1 000 ha between Bridesville and Rock Creek.

For the first time in a decade, defoliation was not recorded in the Fraser or Lillooet river drainages or elsewhere in the Vancouver Region. Larval populations were also low, except at Gilt Creek, south of Boston Bar, where 15% of the buds had been mined.

A forecast of 1983 conditions is based on the increased number of larvae in beating samples and the number of adults caught in pheromone-baited traps at 18 locations beyond defoliated areas and egg counts in defoliated stands (Table 5). Severe defoliation could occur in the Hart Ridge area near Clinton with moderate defoliation in the Kamloops Region near Ashcroft and trace to light defoliation in Fountain Valley and in the Lillooet area. No defoliation is expected in the Vancouver Region.

A cooperative experimental aerial spray trial to evaluate nuclear polyhedrosis virus (NPV) and granulosis virus (GV) for the regulation of western spruce budworm was initiated near Ashcroft by Pacific Forest Research Centre and Forest Pest Management Institute personnel. The NPV had a greater, initial impact and reduced the population by 52%, compared to 35% with GV. Carry-over effects and the ability to initiate an epizootic will be assessed in subsequent years.

WESTERN FALSE HEMLOCK LOOPER
Nepytia freemani

Douglas-fir stands in the Salmon Arm-Shuswap Lake area were defoliated for the second consecutive year and the area expanded to 12 locations totalling 1 150 ha (see map), an increase from 350 ha in 1981. Only a few *Beauveria*-diseased larvae were collected in 1982 and egg survey results of 465 and 172 eggs per [illegible] of foliage and high numbers of moths in flight in the [illegible]appen-Sunnybrae-Salmon Arm area indicate that l[illegible]t to moderate feeding will occur in 1983.

RHIZINA ROOT ROT
Rhizina undulata

This root rot is occasionally found in recently burned sites. Near Powell River, 40 Douglas-fir seedlings were killed in part of a block which was slash-burned in 1980 and planted in 1981.

DOUGLAS-FIR BEETLE
Dendroctonus pseudotsugae

The majority of the 4 700 dead, mature Douglas-fir trees observed in 1982 were in the Cariboo Region where tree mortality was also recorded in 1981. Scattered mortality occurred near Loon Lake; on the Fraser River plateau in Empire Valley; along Dog, Gaspard, and Riske creeks; and north of Williams Lake to McLeese Lake. Elsewhere in the province, the number of recently attacked trees declined, occurring singly or in small groups at widely scattered locations in Kamloops, Nelson, and Vancouver regions, with none recorded in the Prince George or Prince Rupert regions.

Table 5. Pheromone trap catches of western spruce budworm, egg mass counts, and predicted defoliation for 1983.

Location	No. of Stands Sampled	Adults per Trap at Concentration			Egg Masses per 10 m^2 of Foliage	Predicted Defoliation[a] 1983
		0.1%	0.01%	0.001%		
Vancouver Forest Region:						
Hope	2	15	3	0.2	0	---
Fraser Canyon	2	35	19	5	0	---
Pemberton	4	45	14	2	0	---
Kamloops Forest Region:						
Lillooet	4	52	59	39	------	---
Ashcroft	1	117	115	53	150	M
Burton Creek (Adams Lake)	1	16	5	1	------	---
Scotch Creek	1	30	8	0	------	---
August Lake	1	59	13	1	------	---
Spius Creek	1	19	2	1	------	---
Cariboo Forest Region:						
Hart Ridge	1	92	72	66	280	S

[a] Egg mass counts and potential defoliation:

up to 50 = (L) light
51 to 150 = (M) moderate
151+ = (S) severe

True Fir Pests

BUDWORMS
Choristoneura spp.

Defoliation of alpine fir and spruce was evident only over a total of 200 ha near Crescent Lake in the Cariboo Region and in the St. Mary's River drainage in the Nelson Region. In 1980, the previous year of major feeding, more than 365 000 ha had been defoliated throughout central British Columbia. The cause of the decline is not known.

In the Prince Rupert Region, light to moderate feeding on current and some older foliage of alpine fir and spruce occurred over 89 000 ha in the Bell-Irving-Meziadin-Nass and Babine-Kispiox river drainages and on 1 000 ha near Atlin (see map). In 1981, 39 000 ha were defoliated. This budworm appears to have a one-year cycle and is undergoing taxonomic review. Moderate to severe defoliation in 1983 is forecasted, based on fall egg mass surveys in five areas. The pathogen, *Beauveria bassiana*, was present on dead larvae and pupae on 10, 60, and 90% of the trees sampled in three stands in the Nass-Meziadin and Babine river areas and on 0 and 60% of the trees in two stands near Kispiox.

WESTERN BALSAM BARK BEETLE
Dryocoetes confusus

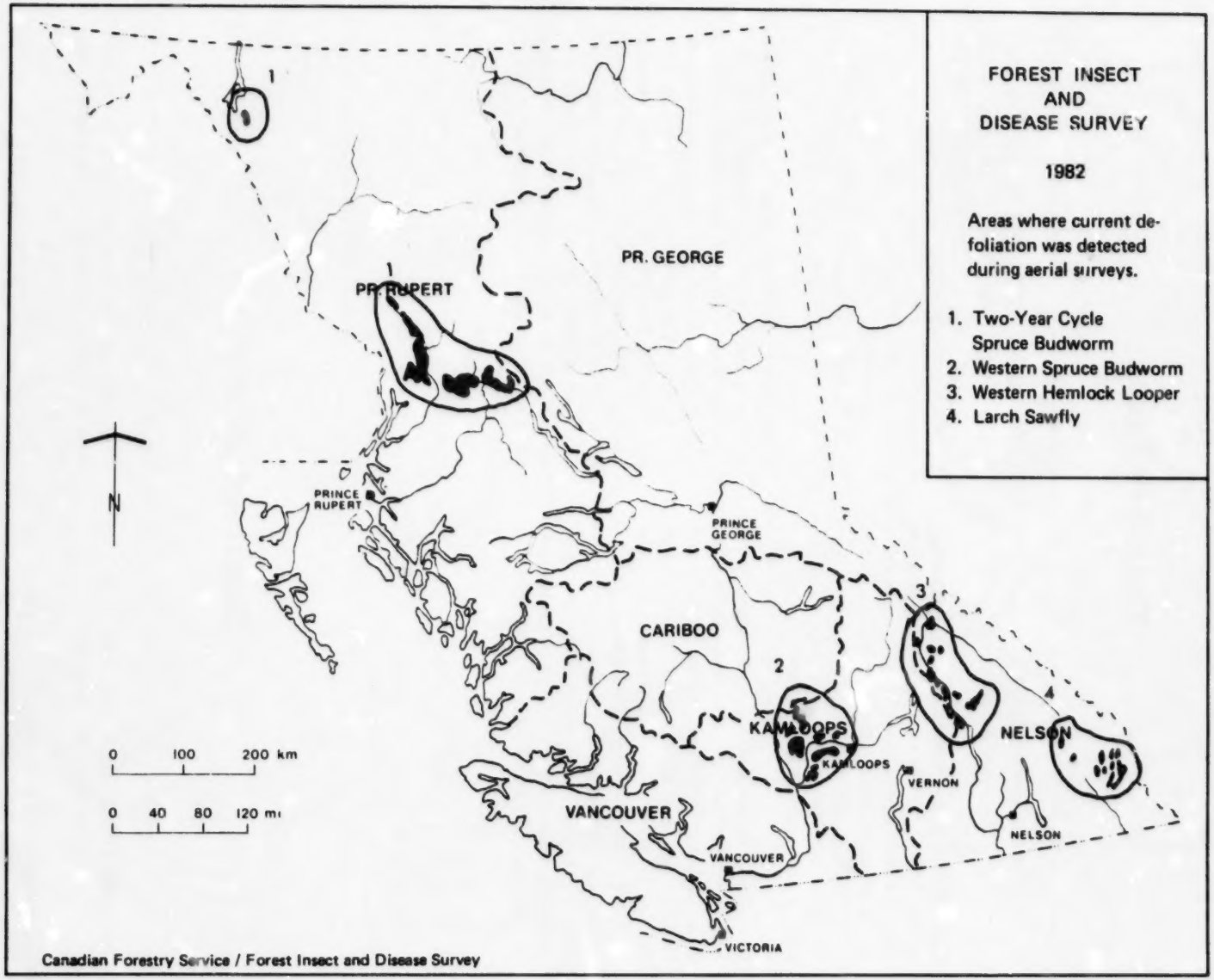
Sporadic outbreaks of the balsam bark beetle with the associated fungus *Ceratocystis dryocoetidis* have, over the years, killed alpine fir over extensive areas in the province. Annual tree mortality continued, with more than 130 000 mature alpine fir trees killed over 24 000 ha. The highest incidences occurred in the Bulkley TSA in the Prince Rupert Region where 63 000 trees were killed over 18 000 ha. Other regional estimates of beetle-killed trees were 21 500 in Prince George, 15 000 in Nelson, 5 800 in Cariboo, and 2 000 in Kamloops.

Hemlock Pests

WESTERN HEMLOCK LOOPER
Lambdina f. lugubrosa

Larval populations which started to build up in 1981 in the Columbia River Valley between Revelstoke and Wood Arm, east of Mica, defoliated 6 500 ha of mature western hemlock-western red cedar forest in 1982 (see map). Defoliation, the first since the 1972-1973 outbreak, was light over 4 350 ha, moderate on 2 000 ha, and localized severe areas totalled 150 ha.

Elsewhere in the province, defoliation was not observed and larval populations remained low, except near Coquitlam Lake in the Vancouver watershed where numbers have fluctuated since 1980.


FOREST INSECT
AND
DISEASE SURVEY
1982
Areas where current defoliation was detected during aerial surveys.
1. Two-Year Cycle Spruce Budworm
2. Western Spruce Budworm
3. Western Hemlock Looper
4. Larch Sawfly
PR. GEORGE
PR. RUPERT
PRINCE RUPERT
PRINCE GEORGE
CARIBOO
KAMLOOPS
VERNON
NELSON
VANCOUVER
VICTORIA
N
0 100 200 km
0 40 80 120 mi
Canadian Forestry Service / Forest Insect and Disease Survey

Populations and severe defoliation will likely continue in the Nelson Region in 1983. High numbers of viable eggs were present at Red Rock Harbor north of Mica and at Begbie Creek, averaging 263 and 253 per sample, respectively. Egg parasitism was negligible. A previous 28 000 ha infestation collapsed in the spring of 1974, with 37% parasitism in somewhat lower amounts of eggs.

PHANTOM HEMLOCK LOOPER
Nepytia phantasmaria

Although increased numbers of western hemlock looper were observed near Coquitlam Lake in the Vancouver watershed, the moderate defoliation of immature and mature hemlock west of the lake and more severe defoliation in two patches to the south totalling 100 ha was caused by phantom hemlock looper. About 80% of the larvae collected in August were infected by the diseases *Entomophthora* sp. and *Paecilomyces* sp. However, egg counts in October were sufficiently high (averaging 243 per 10 m^2 foliage area) to expect continued but lighter defoliation in 1983. A previous infestation in the same area subsided in 1972, as did a localized infestation in the Municipal Park at Hope in 1958—both presumably due to parasitism or disease.

TERMINAL CROOK DISEASE
Colletotrichum acutatum

The terminal disease, which causes crook disease of radiata pine in New Zealand, was found for the first time in North America and for the first time on western hemlock on seedlings in an Aldergrove nursery. Six of eight western hemlock seedlots were infected, but none of the Sitka spruce or western red cedar. All hemlock seedlings were destroyed and the area treated with a disinfectant.

Near Northwest Bay on Vancouver Island, 70 000 hemlock seedlings, outplanted in 1981 from the Aldergrove stock before the pathogen was identified, were sampled twice in 1982. Surveys indicated that at least one infected seedling had been outplanted but the fungus had apparently failed to survive the winter. Inspections will continue in 1983.

Larch Pests

LARCH SAWFLY
Pristiphora erichsonii

An outbreak developed quickly in the Nelson Forest Region where larch stands were severely defoliated over 12 000 ha in about 50 locations near Corbin, Fernie, Sparwood, Fording, Bull River, Dutch Creek, and at Jack Creek in the White River drainage (see map). The previous five-year outbreak collapsed in 1980. Overwintering pupal numbers in duff samples indicate continuing population in all areas, except near Dutch Creek where x-rayed cocoons showed incomplete pupal development, the cause of which has not been determined.

LARCH CASEBEARER
Coleophora laricella

Casebearer defoliation of western larch stands in the Nelson and Kamloops regions declined further from the low levels of 1981. Only localized patches of light defoliation occurred near Rykerts and Jaffrey. At these low levels, larval parasitism decreased to about 12%, most of it caused by *Chrysocharis laricinellae*. In 1981, *Dicladocerus* had been most common, parasitizing about 35% of the casebearer sampled.

LARCH NEEDLE DISEASES

Hypodermella laricis
and
Meria laricis

The extent and intensity of these needle diseases in the Nelson Region declined greatly since 1981. *Hypodermella* infected only localized stands between Salmo and Trail and near Nancy Greene Park, but moderate discoloration occurred over 700 ha at Stagleap Creek and about 20% of the larch between Silverton and Slocan was infected. Immature stands south of Cranbrook were lightly discolored and small areas between Moyie Lake and Yahk were moderately and severely affected.

Meria was not found in the Slocan, Trail, and Salmo area, but twig dieback was common on the lower third of the crown of trees severely infected by both pathogens for the past two or more years.

EUROPEAN LARCH CANKER
Lachnellula willkommii

The disease, which infects all age classes of all larch species and which could have a significant impact on western and eastern larch stands, has not been collected to date in British Columbia. Its distribution is currently limited to several locations in New Brunswick, Nova Scotia, and some eastern states.

Multiple-Host Pests

ROOT AND STEM ROTS

Root rots such as *Phellinus weirii*, *Armillaria mellea*, *Polyporus tomentosus*, and *Verticicladiella wageneri* continue to cause decay and mortality, resulting in openings in young and mature Douglas-fir, pine, and spruce stands throughout the province. From limited surveys near Salmon Arm, *Armillaria* and *Phellinus* have killed 75% of the mature Douglas-fir over 20 ha near White Lake and up to 15% of the Douglas-fir in scattered pockets over 1 000 ha along Adams Lake.

In one research study, several stands in coastal British Columbia were assessed for *Fomes annosus* three years after being spaced. At Jordan River and near Terrace, respectively, 15 and 23% of the western hemlock stumps and 49 and 45% of the amabilis fir stumps were infected. The fungus was traced into the stump roots and to adjacent residual trees via root contacts. With significant amounts of *Fomes annosus* in stumps larger than 15 cm, topical stump treatments to prevent infection should be considered.

A high incidence of red ring rot, *Fomes pini*, contributed to the blowdown of mature white spruce and necessitated the temporary closure of a campground at Horseshoe Bay in Kluane National Park, Yukon. A hazard-tree removal program was initiated, which also included the nearby Congdon Creek campsite.

The heart rot, *Echinodontium tinctorium*, is visible in western hemlock in many parts of the Kamloops and Nelson wet belt, where as much as 80% of the mature stems are decayed.

BLACK ARMY CUTWORM
Actebia fennica

Outbreaks developed with little warning in several plantations slash-burned in 1979 or 1980 and killed or damaged more than 32 500 conifer seedlings. More than 20 000 newly planted lodgepole pine seedlings were killed on 17 ha in the North Thompson drainage

in the Kamloops Region. About 12 500 lodgepole pine seedlings, half of the total planted, were killed or damaged at Dog Creek south of Fort St. James in the Prince George Region and localized damage was reported near McLeod Lake, at Stephanie Creek in the Willow River Valley, and at Kalder Creek.

In the Prince Rupert Region, newly planted white spruce was defoliated and leaders killed over 10 ha near Guess Creek along the Houston-Chapman Lake Road. High numbers of larvae were also found at sites near Cross Creek at the south end of Babine Lake and along the Natlin River; however, most of the feeding was restricted to herbaceous plants.

Some feeding on herbaceous plants occurred in a localized grassland area 19 km north of Whitehorse, Yukon. The cutworm, first reported causing damage to conifers in British Columbia in 1964, had previously been reported in high numbers on fireweed near Whitehorse in 1961.

Populations are expected to persist in most of the areas in the three regions based on the number of pupae or adult male moths attracted to baited traps. Duff samples at Cross and Guess creeks contained 25 and 8 pupae, respectively, and at Stephanie Creek in the Prince George Region there were 20 to 50 per 1 000 cm^2 sample. However, pupal parasitism or predation this winter could reduce the population. Baited traps near Bobo and Adolph creeks in the North Thompson River Valley and near Guess Creek and Bristol and Chapman lakes in the Prince Rupert Region attracted an average of 5, 6, 26, 30, and 34 adults, respectively. The significance of the number of adults per trap, beyond identifying the pest's presence, is presently being established.

PESTS IN YOUNG STANDS

Pest problems were assessed in 156 young stands and plantations, 69 of which were managed under spacing, thinning, or fertilization programs (Table 6).

Major pests in 63 interior lodgepole pine stands included stem and gall rusts which infected an average of 17% of the trees in 25 stands and a pine terminal weevil which killed an average of 9% (range 1 to 30%)

Table 6. Common pests in young stands, British Columbia, 1982.

Tree Species	No. of Stands Examined		Common Pests
	Natural	Managed	
Lodgepole pine	47	16	Dwarf mistletoe, terminal weevil, stem and gall rusts, root collar weevil, needle miner, animal damage, climatic injury
Spruce:			
Engelmann	25	1	Terminal weevil, spruce aphid, animal damage
White	3	7	
Sitka	1	9	
Douglas-fir	5	21	*Armillaria*, *Phellinus* root rots, climatic injury
Western hemlock	3	3	Dwarf mistletoe, *Armillaria*
Mixed species	3	12	Climatic injury

of the new leaders in 17 stands in the Cariboo Region. Other pine pests included dwarf mistletoe; Atropellis canker, which affected 11% of the stems in two natural stands; and a needle miner that lightly defoliated an average of 42% of the trees in four areas and killed the terminal growth of 5% of the trees in a fifth area in the Prince Rupert Region. A root collar weevil damaged 6% of the trees in five areas in the Prince Rupert and Prince George regions, and porcupine damage and snow breakage affected 17 and 60% of the trees in each of two areas.

In the Yukon, no major pest problems were observed in three 10- to 15-year-old natural lodgepole pine stands, although pitch moth and gall rust affected 1% of the trees in a provenance trial area. Rabbit feeding and a stem rust affected 20% of the trees in one natural stand.

Of the 26 Douglas-fir stands examined, *Phellinus* root rot occurred in 6. *Armillaria* root rot affected 2 and 20% of the trees in two stands in the Vancouver Region and reached 30% in a natural stand near Crawford Bay in the Nelson Region. Other pests included *Rhabdocline* needle disease, causing significant premature needle drop; drought injury (20% of the trees affected in one area); and snow breakage which damaged leaders and branches on up to 30% of the trees in six-year-old plantations in the Nelson Region.

The major pest of the spruce stands examined was the terminal weevil (see Spruce Pests).

Dwarf mistletoe was the major pest in young hemlock, occurring in 2 of the 6 stands examined; *Armillaria* killed individual trees and porcupines girdled 4% of the trees near Greenville in the Prince Rupert Region.

In the 15 mixed stands examined, snow breakage was the most serious problem, affecting 60% of the 20-year-old Sitka spruce and western hemlock in one of three Prince Rupert Region plantations.

CONE AND SEED PESTS

Cone crops were generally light or moderate for most species, with localized areas of moderate to heavy in Douglas-fir stands in the southern interior and in spruce stands across the province. Cone and seed pests were assessed in 40 areas in the Kamloops, Nelson, Prince George, and Prince Rupert regions (Table 7).

A spruce cone maggot, *Hylemya* sp., and, to a lesser degree, a cone seedworm, *Cydia youngana*, infested 59% (range 35 to 93%) of the white spruce cones at 13 locations in the Prince George Region. Other regional averages ranged from 31 to 53%.

In the 25 spruce stands examined, cone rust, *Chrysomyxa* sp., infected 26 and 5%, respectively, of the cones near Pinkut and Aldrich lakes in the Prince Rupert Region and 10% of the cones near McGillivray Lake northeast of Kamloops.

Douglas-fir cones infested by the cone moth, *Barbara colfaxiana*, the cone worm, *Dioryctria abietivorella*, and a seed chalcid, *Megastigmus* sp., averaged 99% in four stands in the Nelson Region and 20% in the Kamloops Region. The cone moth, cone midges, *Contarinia* spp., and seed chalcids lightly infested (15, 10, and 5%, respectively) Douglas-fir cones in three areas on Vancouver Island.

A single collection of lodgepole pine cones from the Yukon Territory was healthy, but 33% of the ponderosa pine cones from Stump Lake north of Merritt were infested by maggots, seedworms, and a midge, *Dasineura* sp. An average of 27% of the alpine fir cones in four areas in the Prince George Region were infested by seed maggots and midges.

A SEEDLING WEEVIL
Steremnius carinatus

Mortality of newly planted seedlings was recorded on Vancouver Island for the first time in recent years. An estimated 40% of the amabilis fir seedlings in one of nine 1981 plantations in the Holberg-Winter Harbour area were killed.

Heavy basal feeding occurred on up to 75% of the western hemlock seedlings examined in eight plantations in the same area, but no mortality was recorded.

RABBIT DAMAGE

Recent feeding debarked 28% of the 10-year-old spaced and fertilized lodgepole pine west of Spillimacheen in the Nelson Region. Damage was recorded in the area in 1980 and 1981, with up to 54% of the trees being damaged.

Table 7. Location and incidence of cone and seed pests in British Columbia, 1982.

Location (By Forest Region)	Host	No. of Stands Examined	Percent of Cones Affected			Average of Infested Cones
			Total			
			Range	Average	Pests	
Kamloops	D-fir	5	5 to 30	20	*B. colfaxiana*	20
					D. abietivorella	8
					Megastigmus sp.	8
	eS	3	30 to 70	53	*Chrysomyxa* rust	10
					Cydia youngana	70
					Hylemya spp.	35
					Dasineura spp.	15
	pP	1	----------	33	*Hylemya* spp.	55
					Cydia youngana	10
					Dasineura spp.	15
Nelson	D-fir	4	98 to 100	99	*B. colfaxiana*	90
					D. abietivorella	66
					Megastigmus sp.	25
	eS	2	----------	46	*Hylemya* spp.	50
					Dasineura spp.	45
Prince George	wS	13	35 to 93	59	*Hylemya* spp.	47
					Cydia youngana	11
	alF	4	3 to 44	27	*Earomyia* spp.	19
					Seed midges	8
Prince Rupert	wS	7	5 to 55	31	*Hylemya* spp.	31
					Cydia youngana	11
					Chrysomyxa rust	4
Vancouver	D-fir	3	5 to 25	15	*B. colfaxiana*	15
			5 to 15	10	*Contarinia oregonensis*	10
			----------	----	*Megastigmus* sp.	5
Yukon	lP	1	Healthy			
Total		43				

Basal girdling of 1 to 30% of the regeneration lodgepole pine in localized pockets was common in the Yukon along Lake Laberge, north of Whitehorse, and northwest of Carmacks. Similar injury to trembling aspen regeneration occurred in the Ross and Lapie river areas.

RED BELT

Winter drying of lodgepole pine and, to a lesser degree, white spruce and alpine fir, was widespread in the Prince George Region. Discolored stands occurred from Pine Pass to Chetwynd; along the Alaska Highway north of Fort St. John to Pink Mountain and between Summit Lake and Fireside; and on Sinkut Mountain near Vanderhoof.

FUME INJURY

A small stand of Douglas-fir and lodgepole, white, and ponderosa pine and mature birch trees above West Trail was discolored, with symptoms typical of sulphur dioxide fumes. Up to 60% of the foliage was discolored but no long-term injury is expected.

Deciduous Tree Pests

BIRCH LEAF MINERS

Bucculatrix canadensisella
and
Lyonetia saliciella

Foliar skeletonizing and discoloration of western birch by *B. canadensisella* was light to severe over 2 000 ha between Trail and Blueberry Creek in the Nelson Region, particularly along the Columbia River near Sunnydale to Blueberry Creek. White birch were severely discolored for the first time since 1980 in the Valemount-McBride-Moose Lake area in the Prince George Region.

Another birch leaf miner, *Lyonetia saliciella*, previously identified as *Bucculatrix* spp. in the Nelson Region, severely affected western birch and willow in the Columbia River Valley from Invermere north to Donald, in the Beaverfoot River Valley, and in Yoho National Park. Glacier National Park defoliation was moderate between Stoney Creek and the north park boundary.

WINTER MOTH
Operophtera brumata

Garry oak, maples, and fruit trees in the Greater Victoria area were defoliated for the twelfth consecutive year. Although generally lighter than in recent years, some localized pockets of severe defoliation occurred on the Saanich Peninsula.

Preliminary surveys indicate that *Cyzenis albicans* and *Agrypon flaveolatum* parasites released annually between 1979 and 1982 are becoming established in sufficient numbers to start affecting the population.

WESTERN OAK LOOPER
Lambdina f. somniaria

Garry oak and Douglas-fir in a 16 ha ecological reserve on Saltspring Island were moderately defoliated for the third consecutive year. Douglas-fir bark beetle recently attacked and killed 4 of the severely defoliated trees.

GYPSY MOTH
Lymantria dispar

Gypsy moth is a destructive feeder on most hardwoods and to a lesser degree on conifers in northeastern North America, where in 1982 it caused severe defoliation over more than 8 million ha. In September 1982, a total of 10 male moths were caught in 7 of the traps set by Agriculture Canada in Greater Vancouver, including Capilano Canyon, Mount Seymour Parkway, Fort Langley, and Abbotsford. None were detected in the forested recreational parks throughout the province in traps set by the Forest Insect and Disease Survey. Subsequent egg mass searches in the Vancouver area were negative. At present, possible quarantine restrictions are more of a concern than the threat of any defoliation.